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MULTIPLE INTELLIGENCES  
AND READING ABILITY

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A Thesis  
Presented to the  
Faculty of  
California State University,  
San Bernardino

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts  
in  
Education: Elementary Education Option

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by  
Lauree Smith Simpson

June 1996

MULTIPLE INTELLIGENCES  
AND READING ABILITY

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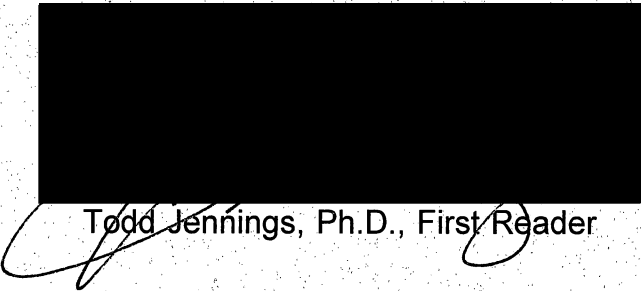
A Thesis  
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by  
Lauree Smith Simpson

June 1996

Approved by:

  
Todd Jennings, Ph.D., First Reader

5-28-96  
Date

  
Myra Coleman, M.A., Second Reader

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## ABSTRACT

Research was conducted to determine if there is a difference within the multiple intelligences of children who are having difficulty reading and those who are not. Students in grades one through four were tested using the *Teele Inventory of Multiple Intelligence*. Chapter One designation was used to identify students who were having difficulty reading or learning to read. An equal number of non-Chapter One students were tested at each grade level as the control group. Overall, 186 students' scores were analyzed for this research. t-Tests were performed to determine significance. Research showed a statistically significant difference in linguistic intelligence when grades one through four were analyzed together. t-Tests performed at each grade level showed a significant difference within first and fourth grades in linguistic intelligence, with Chapter One students scoring lower than non-Chapter One students. Possible reasons for these differences are discussed.

## DEDICATION

Lyndsee, Drew, and Sam: you are the wind beneath my wings.

and

My Mom and Dad, who always believed I could fly.

## ACKNOWLEDGEMENTS

Deb and Luther Austin-Brecher

Renee and Brian Bascom

Dave Humphries

Todd Jennings

Barbara and Roy Rencher

Sarajane Wallace

Thank you for standing between me and the storm,  
and staying until the sun came out.

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## INTRODUCTION

Working with young children in the school setting, teachers often wonder why some children learn with ease the same material that other children find very difficult. Is mastery of a topic, task, or subject due to one's level of intelligence or other factors? Answering this question could provide valuable information for children and adults.

The following research focuses on intelligence as it relates to reading. To make reading possible for every child, varied reading materials, methods, and models must be available. Once these elements are in place for the potential reader, does intelligence make the difference in reading ability?

This research compared multiple intelligence scores of competent readers to multiple intelligence scores of struggling readers (Chapter One students). Comparisons were made at each grade level (first through fourth) to ascertain if intelligence was a determining factor in reading ability.

## LITERATURE REVIEW

### Evolution of Intelligence

Intellectual ability and its origin has long been a debatable issue. Four-year-old Wolfgang Amadeus Mozart astounded his father, Leopold Mozart, by writing an extremely complicated concerto. Eventually, of course, Mozart became the greatest composer of his time. More than a century later, Leo Wiener, seeing his young son, Norbert, unhappy with formal education, decided to educate Norbert himself. The father imparted his own broad interests and knowledge to his son. Norbert entered Tufts College at eleven, graduated from Harvard at fourteen, and became a famous mathematician and the originator of cybernetics.

When Mozart's and Wiener's parents were questioned regarding the source of each child's exceptional abilities, the explanations were very different. Leopold Mozart believed his son had been born with unparalleled musical ability, enhanced by the child's careful nature. Leo Wiener attributed his son's unusual ability to training and experience.

The explanations by these two parents of exceptional children encapsulate the intelligence controversy; this controversy being whether intelligence is learned or innate. This long-standing question prompted extensive writings by John Stuart Mill (1806-1874) and Francis Galton (1822-

1911). Both Mozart and Wiener were seen as child prodigies, yet Mill and Galton each came to his own conclusion about the major differences between people in ability and character. Mill argued that the greatest differences between individuals are due to environment and circumstances. However, Galton was one of the first people to argue that major psychological characteristics are innate and directly relate to the size of the brain or skull. The opposing ideas of Mill and Galton are echoed in contemporary debates over intelligence (Gould, 1981).

In 1890 James McKeen Cattell combined his own ideas concerning intelligence with the research and writings of Francis Galton, and produced an article entitled "*Mental Tests and Measurements*." He outlined a set of ten mental tests designed for the general public and fifty tests for college students. The notion of mental tests caught on with enthusiasm in many countries. Gradually the mental tests were seen as incomplete and of little use in determining mental functions as they had been designed to do.

In 1905 a very different approach to intelligence testing was introduced by Alfred Binet. The city fathers of Paris were seeking a reliable testing method that would identify students who were not performing well in regular education. In response to the city's request, Alfred Binet and his student, Theodore Simon, developed a standardized intelligence test. This test supported the notion that intelligence could be measured and quantified. Binet came to see intelligence as "the exercise of multifarious psychological faculties

in the real world, tied together by and always under the control of practical judgment (Gould, 1981, p. 124)." In setting out to create a test of intelligence, Binet and Simon wanted it to be "psychological" in nature rather than "pedagogical" in nature. The goal being to avoid problems that depended mainly on reading, writing, or other school-related abilities for accurate completion. This concept remained at the core of Binet's test design through two revisions presented in 1908 and 1911. Throughout these revisions Binet advised those interpreting the intelligence level of any child not to take the results as an absolute innate measure. He cautioned that circumstances affect testing and strongly believed "intelligence" was open to substantial change within any individual.

Binet's test found its way to the United States in 1908 but received only moderate success until after World War II. Binet's intelligence measure was drastically altered in America. American hereditarians ignored Binet's caveats, which were that his test provided a score to be used as a practical device, not to define anything innate or permanent; that the scale was a rough guide for identifying children who needed help, not for ranking normal students; and that it was an empirical guide for finding children who needed improvement. The American application of the Binet test as adapted by the Stanford-Binet has blatantly violated all three of Binet's principles for using his test (Gould, 1981).

Lewis Madison Terman, along with his Stanford University student H. G. Childs, was impressed with Binet's techniques of testing. Revisions, deletions,

and additions were made to the Binet-Simon assessment. Though Binet's fifty-four tasks were substantially extended to include ninety tasks, the major shift of focus came when Terman administered the test to large groups of children simultaneously. Binet had previously tested children one-on-one. Terman "hoped to test everybody, for he hoped to establish a gradation of innate ability that could sort all children into their proper stations in life (Gould, 1981, p. 132)." In 1916 Terman and Childs produced the "Stanford Revision of the Binet-Simon Scale," soon known as the "Stanford-Binet." This revision quickly dominated the field of intelligence testing. With the Stanford-Binet came a new term: "intelligence quotient," IQ for short. This accompanied the now classic formula:

$$IQ = \frac{\text{Mental Age}}{\text{Chronological age}} \times 100$$

The Stanford-Binet has been widely used and considered a valid assessment of young people.

Mill, Galton, and Binet all contributed to the philosophical development of Charles Spearman (1863-1945). Through obtaining teacher ratings of students and their grades, Spearman developed the concept of general intelligence. However, Spearman's theory of general intelligence had two inherent flaws. First, it was too closely tied to academic performance to be useful in determining actual intelligence. Second, the test scores produced were not quantifiable.

In 1949 David Wechsler incorporated Spearman's concepts of general intelligence and added the important factors of motivation and personality in developing the Wechsler Intelligence Scale (WISC). The popularity of his adult testing prompted him to extend his testing to children as well. Wechsler's allowing for profile analysis and global IQ scores indicate a return to Binet's attitudes and philosophy.

The idea that intelligence could be measured and encapsulated into a single number, or IQ score, was seen as a genuine psychological breakthrough. IQ, according to Funk and Wagnalls (1989), is "a number expressing the intelligence of a person, determined by dividing the person's mental age by his or her chronological age and multiplying by 100." Such a concise, convenient accounting of intelligence continues to be popular. Having one measure of mental ability that can rate large groups of people is still considered by many to be a useful scientific tool.

However, in 1983 Howard Gardner seriously questioned regular assessments of pencil and paper performances of isolated tasks to determine levels of intelligence. Through cognitive science (the study of the mind) and neuroscience (the study of the brain), Gardner developed his theory of multiple intelligence. He believed the concept of IQ needs to be replaced with information from more natural sources about how people solve problems and develop skills necessary for their life style.



Gardner formulated his concept of intelligence through two sources. The first and more plentiful source being what we already know about normal child development. The second source of information was gathered through studying the breakdown of normal brain functions when the brain is damaged. Gardner did not seek the customary comfort of a single number to express intelligence. His research produced, described, and documented seven different intelligences.

A valid question at this point may be, "What then constitutes an intelligence?" Gardner states:

In coming up with our list, we consulted evidence from several different sources: knowledge about normal development and in gifted individuals; information about the breakdown of cognitive skills under conditions of brain damage; studies of exceptional populations, including prodigies, idiot savants, and autistic children; data about the evolution of cognition over the millennia; cross-cultural accounts of cognition; psychometric studies, including examinations of correlations among tests; and psychological training studies, particularly measure of transfer and generalization across tasks. Only those candidate intelligences that satisfied all or a majority of the criteria were selected as bona fide intelligences (Gardner, 1993, p. 16).

Furthermore, each intelligence must have an identifiable set of core operations. For example, sensitivity to pitch is one core of musical intelligence. Additionally, an intelligence must have a symbol system for creating, capturing, and expressing information. Language (written or verbal), picturing, and mathematics are three symbol systems accepted universally. It may be possible to have an intelligence that cannot be related to symbols. Part of human intelligence is a desire and ability to express that intelligence.

To grasp the power of Gardner's theory of multiple intelligence, one must make a distinction between how students take in information (the modalities of visual, auditory, etc.) versus how students process information inside their brains in order to first make meaning of the input and then to act upon the world with it. Remember that these seven intelligences are sets of problem-solving skills, not merely gateways through which information passes to reach the brain (Kovalik and Olsen, 1991).

In summary, Howard Gardner (1993, p. 12) states:

It is of the utmost importance that we recognize and nurture all of the varied human intelligences, and all of the combinations of intelligences. We are all so different largely because we all have different combinations of intelligences. If we recognize this, I think we will have at least a better chance of dealing appropriately with the many problems that we face in the world.

## DESCRIBING THE SEVEN INTELLIGENCES

Proponents of multiple intelligence see it as a functional way to use intelligence. Intelligence is now seen as a working force in the lives of children and adults. A detailed discussion of each intelligence follows.

### Linguistic Intelligence/Word Smart

Ludwig Wittgenstein said, "The limits of my language stand for the limit of my world" (The New City School, 1994, p. 96). Using language effectively in writing or speaking is a distinct capability of the linguistic intelligence.

Linguistic intelligence is using language to express oneself. Expression can be oral, written, or in sign language form. Linguistic intelligence includes the ability to manipulate text properly and use language to convince, inform, or remember information.

Some characteristics of the linguistic intelligence are:

- \* Likes to see, say, and hear language
- \* Enjoys reading, writing, and storytelling
- \* Appreciates subtleties of grammar and meaning
- \* Spells easily
- \* Enjoys word games
- \* Understands puns, jokes, and riddles

- \* Uses descriptive language
- \* Memorizes easily
- \* Tells tall tales, jokes, and stories

(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994)

### Logical-Mathematical Intelligence/Number Smart

"A mathematician, like a painter or poet, is a maker of patterns (Hardy, The New City School, 1994, p. 126)." The logical-mathematical intelligence effectively uses numbers and reasoning. Due to the deductive and observational abilities of the logical-mathematical intelligence, it is often referred to as "scientific thinking." This intelligence is nonverbal in nature; a solution to the problem can be formulated before it is written or verbalized.

Logical-mathematical intelligence is evidenced in the ability to find and create order. Using numbers, logic, classification, and reasoning are some attributes of this intelligence.

Some characteristics of the logical-mathematical intelligence are:

- \* Notices and uses numbers, shapes, and patterns
- \* Moves easily from the concrete to the abstract
- \* Likes to manipulate objects and experiment
- \* Asks questions about how things work
- \* Quickly does mental math

- \* Enjoys math activities
- \* Enjoys strategy games
- \* Enjoys computer games and puzzles
- \* Thinks conceptually
- \* Approaches problem solving systematically
- \* Prefers orderly environment
- \* Enjoys comfort of set routines

(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994)

### Spatial Intelligence/Picture Smart

"Art is the only way to run away without leaving home (Tharp, The New City School, 1994, p. 189)." Those with highly developed spatial intelligence usually have a rich inner world.

"The spatial domain involves the ability to conjure mental images and to think and see in 'the mind's eye' (The New City School, 1994, p. 191)."

Seeing the world accurately is part, but not all, of the spatial intelligence. Blind individuals often have a high degree of spatial intelligence by which they orient themselves to their surroundings and environment.

Spatial intelligence is problem solving through visualizing concepts, spatial relations, or graphically representing ideas. This intelligence involves the use and perception of space.

Some characteristics of the spatial intelligence are:

- \* Enjoys maps, charts, and diagrams
- \* Likes to draw, build, design, and create things
- \* Daydreams more than peers
- \* Enjoys art activities
- \* Likes visual presentations and photos
- \* Enjoys puzzles and mazes
- \* Understands more from pictures than reading words
- \* Likes to draw and doodle
- \* Thinks in three-dimensional terms; images, pictures, and color
- \* Enjoys patterns and geometry in math

(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994)

### Bodily-Kinesthetic Intelligence/Body Smart

Margaret Mead said, "Interest and proficiency in almost any one activity - swimming, boating, fishing, skiing, skating - breed interest in many more.

Once someone discovers the delight of mastering one skill, however slightly, he is likely to try out not just one more, but a whole ensemble (The New City School, 1994, p. 72)."

As children develop, body movement and development occurs on a fairly predictable schedule. As the human body develops, skills and tasks are

accomplished or learned to fit the needs of a specific environment. The development of these skills is a form of problem-solving. "Many children need to manipulate and experience to really learn and internalize something. They learn through doing and through multi-sensory experiences (Boggerman, The New City School, 1994, p. 73)."

Bodily-kinesthetic intelligence is the ability to use physical coordination, balance, strength, flexibility, and speed to create and express oneself. An athlete may need whole body coordination to complete a task, whereas a jeweler may use small motor coordination in the fingers to produce the desired results.

Some characteristics of the bodily-kinesthetic intelligence are:

- \* Creates or performs delicate tasks with one's hands
- \* Learns from hands-on experiences
- \* Uses one's whole body to express feelings or ideas
- \* Displays good coordination, agility, strength, and dexterity
- \* Demonstrates skill in crafts
- \* Exhibits good body control
- \* Takes in information through bodily sensations
- \* Uses body language

(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994).

## Musical Intelligence

Victor Hugo said, "Music expresses that which cannot be said and on which it is impossible to be silent (The New City School, 1994, p. 162)."

Music can motivate or touch a person before he has the ability to perform or verbally communicate preferences. Autistic children who can play an instrument but are unable to speak are examples of those who have musical intelligence. There are two dimensions of musical intelligence: those who feel or appreciate music and those who perform or understand musical theory.

Musical intelligence includes those who appreciate and those who produce music. Individuals may possess a mixed combination of musical appreciation and ability.

Some characteristics of the musical intelligence are:

- \* Remembers melodies
- \* Enjoys listening to music
- \* Moves to music
- \* Is sensitive to melody and tone
- \* Notices sounds
- \* Makes up his own songs
- \* Is emotionally touched by songs
- \* Connects experiences to music



(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994)

### Interpersonal Intelligence

Mark Twain said, "The best way to cheer yourself up is to try to cheer somebody else up (The New City School, 1994, p. 6)."

Problem solving with someone is a high priority for the interpersonal individual. The opinions, feelings, and perceptions of others are important.

In most cases the interpersonal intelligence is used when talking. Yet strong interpersonal relationships can exist without talking; such was the case with Helen Keller and her teacher, Annie Sullivan.

Interpersonal intelligence is evidenced by and built upon the ability to distinguish changes in moods, feelings, intentions, and motivations of other people.

Some characteristics of the interpersonal intelligence are:

- \* Understands the feelings, moods, or intentions of others
- \* Has many friends
- \* Helps others eagerly
- \* Prefers problem solving in a group
- \* Settles conflicts with others

(Armstrong, 1994; Austin-Brecher, 1996; The New City School, 1994)

### Intrapersonal Intelligence

Anne Morrow Lindbergh said, "When one is a stranger to oneself, then one is estranged from others, too (The New City School, 1994, p. 35)."

Knowing oneself is vital and comes naturally to the intrapersonal individual.

The intrapersonal individual can understand and guide his own behavior independent of others. He prefers to problem solve alone and does it very well. A person with a high degree of interpersonal intelligence strives to be with others, where one with a high degree intrapersonal intelligence has a strong sense of self.

Intrapersonal intelligence is private in nature. Problem solving is sought and achieved through understanding and working with oneself rather than others. A person using this intelligence recognizes his own wants, needs, and motivations.

Some characteristics of the intrapersonal intelligence are:

- \* Sets goals
- \* Has accurate picture of own strengths and limitations
- \* Solves problems alone
- \* Feels comfortable being alone
- \* Follows personal interests
- \* Daydreams
- \* Exhibits intuition and reflectiveness

(Armstrong, 1994; Austin-Brecher, 1996; The New City School,  
1994)

## IMPORTANT ASPECTS OF THE SEVEN INTELLIGENCES

### Everyone has all seven intelligences.

Some people have very high levels of functioning in one or more intelligence and extremely low levels in the others, such as idiot savants. Developmentally disabled individuals may function at low levels in all of the intelligences. The general population is somewhere in the middle; being highly developed in a few intelligences but with moderate to low development in the rest (Armstrong, 1994).

### Levels of intelligence can change.

Levels of intelligence can be increased in three ways: encouragement, instruction, and modeling (Teele, 1995). For example, learning to play chess can increase one's level of logical-mathematical intelligence in the following ways. First, when learning to play chess, one may need encouragement to try and keep trying. Second, direct instruction about how to play chess will increase the player's ability. Third, playing chess with someone who plays well will increase the learner's ability.

Intelligences are considered "dominant" when used often. Other terminology in describing the state of an intelligence is "active" or "dormant." An intelligence is active when it is being used and dormant when not in use.

It is very helpful to use one's dominant intelligence to increase competency in an area of intelligence that is difficult. For example, a highly spatial student who is struggling with a mathematical concept may benefit from drawing the equation or problem.

#### Intelligences work together.

Learning about the individual intelligences is helpful in identifying one's strengths. In everyday situations many intelligences are working together at the same time. For example, when cooking a meal, one must read the recipe (linguistic), calculate any changes in ingredients (logical-mathematical), cook to please those who will be served (interpersonal), and please one's own taste preferences (intrapersonal) (Armstrong, 1994).

#### There are many ways to use intelligence.

Each person has his own combination of intelligences and capabilities within those intelligences. There is no required set of traits or skills that one must have to be intelligent in a specific area. For example, a jeweler may not be able to play tennis well, yet is highly skilled in manipulating intricate stones and metals. Both tennis and jewelry-making are skills within the bodily-kinesthetic intelligence but each requires different coordination (Armstrong, 1994).

#### It is important to satisfy one's dominant intelligences.

Most people work, learn, and enjoy life more when their dominant intelligence is satisfied. This author believes people can concentrate and learn

more effectively when their dominant intelligence has been or is being satisfied. For example, a highly spatial child can listen more attentively if allowed to draw or doodle while listening. Conversely, when dominant intelligences are neglected, one's level of happiness and feeling of well-being may diminish.

## THE MULTIPLE INTELLIGENCES AND EDUCATION

A project, *"A Study of Schooling,"* (Goodlad, 1984) found that nearly 70 percent of classroom time was devoted to teachers talking "at" students. The next most commonly seen activity was students doing written work in response to verbal or written directions. Most teaching and assessment is done through the linguistic and logical-mathematical intelligences.

We do not see in our description of classroom activity much opportunity for students to become engaged with knowledge so as to employ their full range of intellectual abilities. And one wonders about the meaningfulness of whatever is acquired by students who sit listening or performing relatively repetitive exercises, year after year. Part of the brain, known as Magoun's brain, is stimulated by novelty. It appears to me that students spending twelve years in the schools we studied would be unlikely to experience much novelty. Does part of the brain just sleep, then? (Goodlad, 1984, p. 18)

Many advocates of multiple intelligences believe teachers need to access each student's individual strengths by allowing, valuing, and giving each intelligence equal opportunity for expression in order to bring out the best in each student. Many claim multiple intelligences theory in practice is what good teachers have always been doing. Creatively reaching beyond the textbook, shifting methods of instruction and assignments awakens and involves students. It is unrealistic to expect every classroom lesson or activity to include all the intelligences simultaneously. However, as techniques vary,

focus is placed on different intelligences, and students' needs are more likely to be met at some point during the day. This author believes when a student's dominant intelligence is satisfied, greater cooperation and learning occur.

Proponents of multiple intelligences encourage educators to re-examine the profile for "success" in school by expanding the options given for succeeding. Categorizing students into "learning styles" does not fit every child. Placing students in predefined learning styles can create problems for the teacher and learner. Multiple intelligence practices suggest observing the child first, then shaping the environment to fit the child.

Methods of assessing student performance are in transition. Portfolio assessment is the current focus of student assessment yet standardized testing is required by many school districts. Does the assessment tool give an accurate picture of a student's ability or knowledge? Howard Gardner suggests abandoning standardized testing. "I believe that we should get away altogether from tests and correlations among tests, and look instead at more natural sources of information about how peoples around the world develop skills important to their way of life (Gardner, 1985, p. 62)."

Rather than relying on a single score to measure intelligence in any given area, products and problem solving techniques are the suggested measure. Assessing which intelligence is favored or active when given a choice is very important in understanding and assessing a student. Supporters of multiple intelligences have found satisfaction in assessing, teaching, and



watching students learn and express themselves through the seven intelligences (The New City School, 1994).

## IDENTIFYING INTELLIGENCES IN STUDENTS

At very early ages children begin to show natural ability or preferences. While reliable tests for identifying one's dominant intelligences exist, the best method for identification is observation (Armstrong, 1994). Taking note of what a child chooses to do in his/her spare time can tell a great deal about the child. An easy way to identify intelligences in the classroom is to watch how students "misbehave." For example, the highly spatial child may be drawing or daydreaming, while the interpersonal child may find it difficult to study without talking to other students.

Observation of each student is not always possible in determining dominant intelligences. Consequently, in 1992 Sue Teele developed an assessment known as the Teele Inventory of Multiple Intelligences (TIMI). Using pictures to assess intelligences, each child is given a numerical score for each intelligence. Scores may range from 0 - 8, with 8 being the highest level of that intelligence. Using the TIMI with over 4,000 students, interesting patterns were noted within grade levels.

Sue Teele's research (1995) using the TIMI showed the following dominant intelligences at each grade level.

Table 1.  
*Dominant Intelligences at Each Grade Level*

	Spatial	Math	Body	Music	Linguistic	Intra- personal	Inter- personal
Kindergarten	x	x	x		x		
Grade 1	x	x	x		x		
Grade 2	x	x	x		x		
Grade 3	x	x	x		x		x
Grade 4	x		x	x			x
Grade 5	x	x		x			x
Grade 6	x		x	x			x
Grades 7-9	x		x	x			x
Grades 10-12	x		x	x			x

It is interesting to note that spatial intelligence is strong at all grade levels. "Ironically students enter school at the primary level strong in both linguistic and logical-mathematical intelligences and exit at the high school

level with those two areas sharply in decline even though those are the two intelligences that are predominate in our educational system (Teele, 1995, p. 30)."

Sue Teele's research (1995) using the TIMI showed the following dominant intelligences for female (F) and male (M) students at grades one, four, seven, nine, and twelve.

Table 2.  
*Dominant Intelligences for Female and Male Students*

	Grade 1		Grade 4		Grade 7		Grade 9		Grade 12	
	F	M	F	M	F	M	F	M	F	M
Linguistics	x									
Logical-Mathematical	x	x		x						
Spatial	x	x	x	x	x	x	x	x	x	x
Musical			x							
Bodily-Kinesthetic		x	x	x	x	x	x	x	x	x
Intrapersonal										
Interpersonal					x	x	x	x	x	x

"The TIMI results have provided us with some very interesting data that could be useful in redesigning the instructional process. We need to look at both differences from grade level to grade level as well as gender differences (Teele, 1995, p. 39)." Sue Teele suggests educators take note of dramatic shifts in intelligences and adjust the instructional climate to accommodate the changes.

## IMPLICATION OF MULTIPLE INTELLIGENCE THEORY FOR EDUCATION

Many teachers and schools are embracing and implementing the theories of multiple intelligences. Some schools and districts have committed themselves to and designated themselves as multiple intelligence schools.

Three such schools or districts are: The Key School; Green Tree East Elementary School; and Hart-Ransom Union School District. The following is a synopsis of what is happening in these schools.

The Key School in Indianapolis, Indiana, was founded by eight public school teachers in collaboration with Howard Gardner. These concepts were at the core when creating a "total learning experience:"

A. Daily instruction in all seven intelligences. Along with instruction in the traditional subjects students receive daily instruction in physical education, art, music, Spanish, and computers. Compared with schools nation-wide, these students receive four times more experiences in art, music, and physical education. Each child also learns to play a musical instrument.

B. School-wide themes. Three themes are emphasized throughout the year. Whole areas of the campus may be devoted to theme related projects.

C. Pods. Groups of students with a specific interest work together with a teacher to learn real-world skills related to their interest. Pods focus on disciplines such as gardening or cognitive challenges such as mathematical thinking.

D. "The Flow Room." Several times during the week students visit the "flow room." Games, puzzles, computer software, and other learning materials are available for use.

E. Community Resource Committee. Representatives from business, the arts, cultural clubs, government, and universities present weekly programs to the student body. Often the school-wide theme is incorporated.

F. Heterogeneous Mixed-Aged Grouping. A lottery system of random selection places children at The Key School. Children previously identified as gifted or learning disabled are educated with everyone else, thus contributing to the school's diversity (Teele, 1995, p. 20).

Through instruction in music, dance, computers, the arts, foreign language, and basic skills The Key school hopes to reach across the spectrum of all intelligences.

Green Tree East Elementary School in Victorville, California, designed their mission statement "to make the student the who and why of their plans (Teele, 1995, p. 50)."

Teachers are given the multiple intelligences scores for each student. New students are assessed using the TIMI upon arrival. Integrated reading, writing, and mathematics skills are given focus during the morning academic program. Monthly grade level meetings allow teachers to plan which basic skills to focus on during each trimester.

Portfolios are used for authentic, continuous assessment at Green Tree East. Assessment directly reflects student learning by allowing many ways to express knowledge.

In the afternoon students participate in cross-grade level learning projects. Students are given choices in the project they select. Projects last six weeks. The first five weeks is spent working on the project, while the last week is devoted to the presentation of the project to other students and parents. The projects are designed to utilize one or more of the multiple intelligences. The teachers want to "teach common learning in uncommon curriculum (Teele, 1995, p. 57)." Staff at Green Tree East believe because the students are expected to take responsibility for their own learning, they learn how to learn. The focus of the school is to discover the intelligences of students and staff, capitalizing on learning together.

The Hart-Ransom Union District in Modesto, California, had a two year implementation plan. Strategies within the seven intelligences were utilized for grades kindergarten through eight. Detailed goals were written for teachers,



administrators, and district personnel. All goals focused on serving students better through the multiple intelligences. For example, teachers are encouraged to plan lessons that include each of the intelligences at some time during the week in each subject area. Students know and share their dominant intelligences. When having difficulty in a particular area, students are encouraged to seek help from a classmate who is strong in that area.

Students having difficulty are served through the Child Study Team. The team focuses on multiple intelligence strategies that have been used, dominant intelligences, and emotional needs of the child. The team then brainstorms new strategies within the multiple intelligences to allow and encourage the child to succeed (Boyer, 1994).

Multiple intelligences, though instituted in districts and schools, still derives its power from the work of individual teachers, parents, and children.

The theory of multiple intelligences has changed how several teachers view and teach children. Comments include the following:

Bruce Campbell of Marysville, Washington, has been using multiple intelligence theories for eight years. He explains, "this approach provides so many more opportunities for success. Kids who haven't done well in school suddenly start having positive learning experiences, and their outlook toward school becomes much more enthusiastic. Meanwhile, the children who have traditionally thrived in school are challenged to stretch themselves in new directions (Bailey, 1995, p. 50)."

Carla Mash, a fourth grade teacher, said "Multiple intelligences give youngsters a profound message: If your intelligence doesn't match mine, it doesn't matter - we can learn from each other (Bailey, 1995, p. 51)!"

Joyce Wiley, a retired teacher from the Moraga School District, is currently tutoring children in grades one through five. She tests each of her students using the TIMI then tutors them using their dominant intelligences to strengthen their weaknesses (Wiley, 1996).

Mary F. Daly, who teaches at New City School, says "Multiple intelligences has allowed me to view my students differently. It has given me seven different ways to plan my lessons (The New City School, 1994, p. 264)."

Debra Austin-Brecher has been using multiple intelligences with her fourth grade class for several years. She said, "School should not just be about fitting children into a program. We should fit the program to the child. Multiple intelligences is a way to get the learner-centered program in place."

Many models of multiple intelligence schools and classrooms exist. The common thread woven through each is the knowledge that children learn and see the world in their own unique ways.

## RESEARCH QUESTION

Is there a significant difference, within the multiple intelligences, between students who are having difficulty learning to read (Chapter One) and those who are not?

## METHODOLOGY

### Overview of Research

The research was conducted to determine if there are significant differences between the scores of children who are having difficulty reading and those who are not. Students in first through fourth grades were tested using the *Teele Inventory of Multiple Intelligence*. Chapter One designation was used to identify students who were having difficulty reading or learning to read. The same number of non-Chapter One students were tested at each grade level as the control group.

## OPERATIONAL DEFINITIONS

Variables: For comparison, within the multiple intelligences, data from the same number of Chapter One and non-Chapter One students were used. Chapter One students were predetermined by using the strategy checklist criterion. Non-Chapter One student data was randomly selected. A total of 186 students' TIMI scores were used in this research. Before analyzing the data, all identifying elements, such as student and teacher names, were removed.

Chapter One identification. The school district used in this research identifies and serves children who are having difficulty reading through the federally-funded Chapter One program. Chapter One funding provides additional literacy support through purchasing computers, books, and instructional aides.

Chapter One assessments were conducted by individual classroom teachers using a Strategy Checklist (See Appendix A). Teachers answer yes or no for each student, in response to reading behaviors expected at each grade level. Assessment for Chapter One placement begins at the end of Kindergarten and continues through third grade. Students may be placed in Chapter One and receive services or exit Chapter One at any time during first through third grade. Students are formally assessed twice a year in first and

second grade. Assessment in kindergarten and third grade is done once a year. In addition, teachers can place a student in the program based on classroom observation even if the Strategy Checklist does not recommend placement. Chapter One services are restricted to grades one through three. Fourth grade Chapter One students included in this research are those who were receiving Chapter One services at the end of third grade.

Multiple intelligence assessment. When seeking to examine the multiple intelligences of large student populations, observations are problematic. In response, The *Teele Inventory of Multiple Intelligences* (TIMI), developed in 1992, was designed to identify the dominant intelligences of students in kindergarten through twelfth grade.

The TIMI consists of 56 numbered pictures of pandas representing characteristic behaviors in each of the seven intelligences. Students are shown two specific pictures at a time and asked to choose which one is the most like themselves. They must choose one of the pictures. When completed, the data is coded, categorized, and tallied identifying the students' dominant intelligences. The TIMI is currently being used in over 650 private and public schools within the United States and six other countries throughout the world.

Strengths of the TIMI. No reading is required. Pictures are appealing to children. Pictures depict child-friendly situations, and provide ease of administration and analysis.

Limitations of the TIMI. Gender differences are apparent in some pictures. Not all pictures relate to all children's experiences, and different characterizations exist within one picture. Meaning of the picture may be unclear.

Data analysis procedures. The TIMI provides a score ranging from 0-8 for each of the seven intelligences (0 being a low level of dominance and 8 being a high level of dominance).

Reliability of the TIMI. The TIMI has proven reliable through test and retest studies. The TIMI was administered to students in California and Kentucky at four, three, and two week intervals. The following are the correlations at the .01 significance level.

Table 3.  
*Test-Retest for Students*

Intelligence	4 weeks	3 weeks	2 weeks
Linguistic	.6308	.6213	.6458
Logical-Mathematical	.6602	.6840	.8117
Spatial	.4870	.5812	.7717
Musical	.6002	.6586	.8819
Bodily-Kinesthetic	.5153	.5977	.5881
Intrapersonal	.5417	.4961	.4582
Interpersonal	.5452	.6153	.6546

(Teele, 1995).

Additional statistical analysis of the TIMI is included in Appendix B.

Statistical analysis. In order to determine if there is a statistically significant difference between Chapter One and non-Chapter One populations tested, a t-Test was used comparing student responses on each of the multiple intelligences.

### Participants

The research was conducted in a semi-rural Southern California elementary school. The school population is lower-middle class, primarily English speaking with less than three percent of the students receiving bi-lingual services. Students are predominantly White, with a small percentage of Latino, Black, and other children.

The student population in this research was 186 students, grades one through four. The following categories and number of students exist within the research population:



Table 4.  
*Categories and Numbers of Students in Research Population*

Grade	1	2	3	4
Number	54	62	48	22
Gender	Boys	Girls		
Number	93	93		
English-Speaking	Yes	Limited		
Number	160	26		
Race	White	Black	Latino	Other
Number	136	1	46	3

## RESULTS

Research using the TIMI showed the following dominant intelligences for Chapter One students at each grade level:

Table 5.  
*Dominant Intelligences for Chapter One Students*

	Spatial	Math	Body	Music	Linguistic	Intra- personal	Inter- personal
Grade 1	x	x				x	
Grade 2	x	x			x		
Grade 3	x	x			x		
Grade 4	x			x			x

Research using the TIMI showed the following dominant intelligences for non-Chapter One students at each grade level:

Table 6.  
*Dominant Intelligences for Non-Chapter One Students*

	Spatial	Math	Body	Music	Linguistic	Intra- personal	Inter- personal
Grade 1	x	x			x		
Grade 2	x	x			x		
Grade 3	x	x			x		
Grade 4	x	x			x		

## STATISTICAL RESULTS

Prior to looking at statistical differences between Chapter One and non-Chapter One scores, it was necessary to determine if there were differences between gender, racial groups, and language. t-Tests were used to compare multiple intelligence scores within these groups. No significant difference was found between gender or language. t-Tests performed comparing White and Latino scores showed no significant difference. Due to a very limited student sample of Blacks and other races, a t-Test comparing these races could not accurately be performed.

Statistical significance of the TIMI scores between Chapter One and non-Chapter One students was determined by performing a t-Test for each of the seven intelligences. t-Tests were performed using data from all students in grades 1-4. Additional t-Tests were conducted within each grade level.

## RESEARCH HYPOTHESES and STATISTICAL FINDINGS

The following hypotheses were used to organize data analysis. The following results are from t-Tests performed on data collected from first through fourth grade Chapter One and non-Chapter One students.

1. Null hypothesis: There is no significant difference between first grade Chapter One and non-Chapter One students on the bodily-kinesthetic, linguistic, logical-mathematical, intrapersonal, interpersonal, musical, spatial dimensions of the TIMI measure.

Results: The null hypothesis was not supported. The t-Test showed a significant difference at the .01 level between the chapter One and non-Chapter One first grade students on the linguistic dimension.

2. Null hypothesis: There is no significant difference between second grade Chapter One and non-Chapter One students on the bodily-kinesthetic, linguistic, logical-mathematical, intrapersonal, interpersonal, musical, spatial dimensions of the TIMI measure.

Results: The null hypothesis was supported. The t-Test showed no significant difference at the .05 level between the Chapter one and non-Chapter One students on the bodily-kinesthetic, linguistic, logical-mathematical, intrapersonal, interpersonal, musical, spatial dimensions of the TIMI measure.

3. Null hypothesis: There is no significant difference between third grade Chapter One and non-Chapter One students on the bodily-kinesthetic, linguistic, logical-mathematical, intrapersonal, interpersonal, musical, spatial dimensions of the TIMI measure.

Results: The null hypothesis was supported. The t-Test showed no significant difference at the .05 level between the Chapter One and non-chapter One students on the bodily-kinesthetic intelligence. However, there was a difference at the .0528 level. Although not significant, this may warrant further attention.

4. Null hypothesis: There is no significant difference between fourth grade Chapter One and non-chapter one students on the bodily-kinesthetic, linguistic, logical-mathematical, intrapersonal, interpersonal, musical, spatial dimensions of the TIMI measure.

Results: The null hypothesis was not supported. The t-Test showed a significant difference at the .01 level between Chapter One and non-Chapter One fourth grade students on the linguistic intelligence.

## SUMMARY OF STATISTICAL RESULTS

When all scores from first through fourth grade students were analyzed as a group, a significant difference was found between the Chapter One and non-Chapter One students in the linguistic intelligence. No significant difference was found between Chapter One and non-Chapter One first through fourth grade students in the logical-mathematical, spatial, interpersonal, intrapersonal, and musical intelligences. Although no significant difference was found in the bodily-kinesthetic intelligence, t-Test results were close enough between student groups to warrant reporting.

When the comparisons were broken down by grade level, a significant difference was found between the Chapter One and non-Chapter One students in the linguistic intelligence. No significant difference was found between first grade Chapter One and non-Chapter One students in the logical-mathematical, spatial, interpersonal, intrapersonal, bodily-kinesthetic, and musical intelligences. Likewise, examination of scores from second grade students showed no significant difference between Chapter One and non-Chapter One students in any of the seven intelligences. Also with third grade students, no significant difference was found between Chapter One and non-Chapter One students in any of the seven intelligences.



When scores selected from only fourth grade students were analyzed, a significant difference was found between Chapter One and non-Chapter One students in the linguistic intelligence. No significant difference was found between Chapter One and non-Chapter One fourth grade students in logical-mathematical, interpersonal, intrapersonal, musical, spatial, and bodily-kinesthetic intelligences.

## DISCUSSION

Research done in support of this thesis showed there is a significant difference, within the multiple intelligences, between students who are having difficulty learning to read (Chapter One) and those who are not. Differences were shown in linguistic intelligence between the two study groups in first and fourth grades. Since a major component of linguistic intelligence is related to reading, it is not surprising that Chapter One students scored lower linguistically. Interestingly, the scores do not differ significantly on any other intelligence.

New questions arise at this point due to intelligence differences between the two study groups in grades one and four but no differences in grades two and three. Why are there differences in some grades and not others? While complete answers for the differences would be difficult to specify, discussing possible reasons may be helpful in understanding these students, broadening our view of them and examining methods of teaching.

Through interviewing twenty kindergarten through fifth grade teachers, the following ideas are some possible reasons for linguistic differences in Chapter One students:

- a. Second and third graders are maintaining previously developed reading skills. First graders are learning to read and fourth graders are

reading for content area knowledge. First and fourth grade students are gaining new skills. It is more difficult to learn new skills. This may cause lower test scores.

b. Teachers generally require more academic and social independence of first and fourth grade students. Consequently, teachers' perceptions of more dependent learners and their need for extra help may affect teachers' judgment for placing a child in Chapter One.

c. Some first grade students may not be developmentally ready to read at the same level as their peers.

d. A possible factor contributing to linguistic differences in fourth graders may be problems in basic reading skills that may have gone undetected up to this point. As greater demands are made on the child's ability to learn and apply written information, any reading deficit may be more profound.

e. One cuing system for readers is taking clues from pictures to interpret the text. Fourth graders are highly spatial and yet fourth grade reading material does not provide many visual clues. If a child needs the pictures to assist with comprehension, fewer illustrations presents a new obstacle.

f. As children with reading difficulty progress through the grades, the gap between them and their peers in terms of ability becomes broader.

These variances in reading and behavioral expectations may account for some linguistic differences.

## RECOMMENDATIONS

Looking for ways to understand and help struggling readers is at the heart of this research. This author hopes the following recommendations will help change methods of teaching Chapter One students. These suggestions are based on differences found in this study.

1. Realizing that all children are capable of learning is basic in implementing the philosophy of multiple intelligences. Chapter One students may not be using the intelligences that schools typically value, but their dominant intelligences need to be respected and encouraged.

2. First grade Chapter One students are more intrapersonal than their peers, and therefore need special assistance. With this in mind, some possibilities are these:

- a. Individual reading and writing space needs to be available for the child who will benefit from it. The intrapersonal child needs the option of getting away from the group when feeling overwhelmed with the whole class environment.

- b. Headphones can be made available to help an intrapersonal student block out distractions and noise. This can increase his ability to concentrate.

c. The intrapersonal child usually develops a few especially close relationships. A teacher's aide or parent helper should consistently work with the same children each day to encourage trust and build a continuing relationship.

3. The spatial intelligence is highly developed in first and fourth grade Chapter One students. With this in mind, some possibilities are the following:

a. Whenever possible, these students need to be allowed to illustrate their thoughts along with their reading experiences.

b. Teachers need to select reading materials where the visual clues support and bolster the text.

c. Fourth grade reading material often lacks visual stimulus. To counteract this deficiency, Chapter One fourth grade children can read well-illustrated, easy-to-read books to younger children. Any stigma from this is eliminated because it is socially acceptable to read "easy" books to a younger child.

d. Chapter One students can work with a capable reader who reads the text aloud while the Chapter One student illustrates what he/she is hearing. Then using his illustration, the Chapter One student can write about the story using the text as a reference.

4. Fourth grade Chapter One students need more small group and/or individual reading support. This need could be fulfilled by aides or parent helpers.

5. The musical intelligence is highly developed in fourth grade Chapter One students. With this in mind, some possibilities for further enhancement of this are as follows:

a. Playing music in the background has a calming effect on some students. In the event a child feels pressured during linguistic tasks such as reading or writing, background music may satisfy his dominant intelligence enough to allow him to relax and let more learning take place.

b. Singing songs while reading the words from a printed sheet can enrich language and reading skills.

6. This author believes teaching reading through poetry is effective at any grade level. Few reading activities appeal to as many intelligences as poetry does. However, the poems need to be child-friendly and ones that create vivid images for children. Printing the text with large and clear letters, in the center of the page, leaves space for the student to illustrate around and on the words of the poem. Poetry can reach and satisfy the multiple intelligences in these ways:

- a. Linguistic: Poetry has rich, descriptive language.
- b. Spatial: Poetry creates vivid mental images that encourage illustration.
- c. Logical-Mathematical: Poetry has a predictable pattern and sequence that appeals to a sense of order.

d. Interpersonal: Poetry can be read or shared with someone else, a group, or the entire class.

e. Intrapersonal: Poetry can be read alone.

f. Musical: Poetry is rhythmic and flows much like music.

The philosophy of multiple intelligences offers valuable insights for teachers to assist students in developing their potential. As teachers begin to see children with unique strengths, new methods will naturally evolve.



## CONCLUSION

Whatever the causes for differences between Chapter One and non-Chapter One students, multiple intelligences can provide practical information about the child as an individual. Intelligence no longer needs to be a mystery and children no longer need to be limited by forces outside themselves.

Believing all children can learn and providing opportunities for them to learn through their individual intelligences will generate new enthusiasm and greater respect for learning. Where conventional IQ scores provide a numerical label, multiple intelligences provide tools for building happy, self-reliant children. The concept of multiple intelligences validates strengths that traditionally have not been valued in the educational setting. Seeing diversity in themselves and others accepted, valued, and respected helps children gain necessary skills and self-esteem.

Louis Pasteur said, "When I approach a child, he inspires in me two sentiments; tenderness for what he is and respect for what he may become (Devonshire, 1937, p. 35)." Honoring differences in each other and accepting them in ourselves is what multiple intelligences is all about.

## APPENDIX A

### K-3 CHAPTER 1 STRATEGY CHECKLIST

Child's Name \_\_\_\_\_ Grade \_\_\_\_\_ Track \_\_\_\_\_  
Teacher \_\_\_\_\_ Date \_\_\_\_\_  
School: (Please circle) CES DES RES VES YES (Please mark: Special Ed. \_\_\_\_\_ LEP \_\_\_\_\_)

By the end of Kindergarten, any "no" answer to #13 serves as identification for first grade Chapter 1.

- Yes No 1. Evaluate whether or not the child understands the concept that print carries the meaning (e.g. "Show me where to start reading").
- Yes No 2. Evaluate directionality. Use a book with more than one line of print to test left to right, top to bottom and return sweep (e.g., "Show me where to start. Which way do I go after that?").
- Yes No 3. Evaluate if child looks at pictures to gain meaning.

By mid first grade, any Chapter 1 student receiving a "no" on #1-6 will need a plan modification.

- Yes No 4. Evaluate whether or not the child can distinguish between individual letters and word boundaries (e.g. "Show me one word, two words." "Show me the beginning of a word, end of a word." "Show me one letter, two letters").
- Yes No 5. Evaluate if child understands one to one correspondence.
- Yes No 6. Evaluate if child makes substitutions that don't disrupt meaning.

By end of first grade, any "no" to #1-8 serves as identification for second grade Chapter 1.

- Yes No 7. Evaluate if child uses visual cues (e.g. reads known words, uses letter sound relationships to problem solve new words).
- Yes No 8. Evaluate if child rereads and self-corrects while reading and writing to make sense of text.

By mid second grade, any "no" to #1-10 serves as identification for third grade Chapter 1.

- Yes No 9. Evaluate if child predicts and solves new words by using two types of cues (i.e., cross checking).
- Yes No 10. Evaluate if child understands the meaning of punctuation (e.g. child reads aloud to teacher showing understanding of the purpose of punctuation-- period, question mark, comma, quotation marks).

By mid third grade, any Chapter 1 student receiving a "no" on #1-11 will need a plan modification.

- Yes No 11. Evaluate if child consistently selects at least one of the main ideas from a passage he/she reads silently and child can retell the message.

**\*There exists a strong likelihood that not all reading behaviors a child uses will be observed during any one reading. Rather, judgments should be made after careful analysis of several running records taken over a period of time. Throughout each of the grade levels, success for a child will be dependent greatly on his/her perceptions of self as a confident and competent reader and writer. In addition, the child views self as an author with a developing voice.**

**Grades 1-3: Please attach a copy of the latest running record to this form if there are any "yes" responses to #6-#11.**

**Grades 2-3: No new running record is needed if the previous assessment/running record set indicated mastery of all strategies #1-9.**

## APPENDIX B

Statistical Analysis of the TIMI, as Produced by SYStat:

### FIRST THROUGH FOURTH GRADE COMBINED COMPARISONS:

#### INDEPENDENT SAMPLES t-TEST ON LINGUISTIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	4.419	1.520
2.000	93	5.129	1.548

SEPARATE VARIANCES T = -3.154 DF = 183.9 PROB = 0.002  
 POOLED VARIANCES T = -3.154 DF = 184 PROB = 0.002

#### INDEPENDENT SAMPLES t-TEST ON MATHEMATICAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	4.742	1.706
2.000	93	4.688	1.608

SEPARATE VARIANCES T = 0.221 DF = 183.4 PROB = 0.825  
 POOLED VARIANCES T = 0.221 DF = 184 PROB = 0.825

#### INDEPENDENT SAMPLES t-TEST ON INTRAPERSONAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	3.161	1.498
2.000	93	2.989	1.456

SEPARATE VARIANCES T = 0.794 DF = 183.8 PROB = 0.428  
 POOLED VARIANCES T = 0.794 DF = 184 PROB = 0.428

#### INDEPENDENT SAMPLES t-TEST ON SPATIAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	4.914	1.626
2.000	93	4.849	1.429

SEPARATE VARIANCES T = 0.287 DF = 181.0 PROB = 0.774  
 POOLED VARIANCES T = 0.287 DF = 184 PROB = 0.774

#### INDEPENDENT SAMPLES t-TEST ON MUSIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	2.989	1.578
2.000	93	2.753	1.724

SEPARATE VARIANCES T = 0.976 DF = 182.6 PROB = 0.330  
 POOLED VARIANCES T = 0.976 DF = 184 PROB = 0.330

INDEPENDENT SAMPLES t-TEST ON **BODILY-KINESTHETIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	4.065	1.275
2.000	93	4.183	1.276

SEPARATE VARIANCES T = -0.632 DF = 184.0 PROB = 0.528  
 POOLED VARIANCES T = -0.632 DF = 184 PROB = 0.528

INDEPENDENT SAMPLES t-TEST ON **INTERPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	93	3.699	1.488
2.000	93	3.430	1.521

SEPARATE VARIANCES T = 1.219 DF = 183.9 PROB = 0.225  
 POOLED VARIANCES T = 1.219 DF = 184 PROB = 0.225

INDEPENDENT SAMPLES t-TEST ON **LINGUISTIC** GROUPED BY SEX

GROUP	N	MEAN	SD
2.000	93	4.925	1.623
1.000	93	4.624	1.510

SEPARATE VARIANCES T = 1.309 DF = 183.0 PROB = 0.192  
 POOLED VARIANCES T = 1.309 DF = 184 PROB = 0.192

INDEPENDENT SAMPLES t-TEST ON **MATHEMATICAL** GROUPED BY SEX

GROUP	N	MEAN	SD
2.000	93	4.204	1.557
1.000	93	5.226	1.596

SEPARATE VARIANCES T = -4.418 DF = 183.9 PROB = 0.000  
 POOLED VARIANCES T = -4.418 DF = 184 PROB = 0.000

INDEPENDENT SAMPLES t-TEST ON **INTRAPERSONAL** GROUPED BY SEX

GROUP	N	MEAN	SD
2.000	93	3.323	1.453
1.000	93	2.828	1.464

SEPARATE VARIANCES T = 2.312 DF = 184.0 PROB = 0.022  
 POOLED VARIANCES T = 2.312 DF = 184 PROB = 0.022

INDEPENDENT SAMPLES t-TEST ON *SPATIAL GROUPED BY SEX*

GROUP	N	MEAN	SD
2.000	93	4.871	1.512
1.000	93	4.892	1.550

SEPARATE VARIANCES T = -0.096 DF = 183.9 PROB = 0.924  
 POOLED VARIANCES T = -0.096 DF = 184 PROB = 0.924

INDEPENDENT SAMPLES t-TEST ON *MUSIC GROUPED BY SEX*

GROUP	N	MEAN	SD
2.000	93	2.871	1.663
1.000	93	2.871	1.650

SEPARATE VARIANCES T = 0.000 DF = 184.0 PROB = 1.000  
 POOLED VARIANCES T = 0.000 DF = 184 PROB = 1.000

INDEPENDENT SAMPLES t-TEST ON *BODILY-KINESTHETIC GROUPED BY SEX*

GROUP	N	MEAN	SD
2.000	93	4.258	1.351
1.000	93	3.989	1.184

SEPARATE VARIANCES T = 1.443 DF = 180.9 PROB = 0.151  
 POOLED VARIANCES T = 1.443 DF = 184 PROB = 0.151

INDEPENDENT SAMPLES t-TEST ON *INTERPERSONAL GROUPED BY SEX*

GROUP	N	MEAN	SD
2.000	93	3.559	1.521
1.000	93	3.570	1.499

SEPARATE VARIANCES T = -0.049 DF = 184.0 PROB = 0.961  
 POOLED VARIANCES T = -0.049 DF = 184 PROB = 0.961

INDEPENDENT SAMPLES t-TEST ON *LINGUISTIC GROUPED BY LANGUAGE*

GROUP	N	MEAN	SD
2.000	26	4.885	1.633
1.000	160	4.756	1.565

SEPARATE VARIANCES T = 0.374 DF = 32.9 PROB = 0.711  
 POOLED VARIANCES T = 0.386 DF = 184 PROB = 0.700

INDEPENDENT SAMPLES t-TEST ON **MATHEMATICAL** GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	5.077	1.573
1.000	160	4.656	1.664

SEPARATE VARIANCES T = 1.254 DF = 34.7 PROB = 0.218  
 POOLED VARIANCES T = 1.205 DF = 184 PROB = 0.230

INDEPENDENT SAMPLES t-TEST ON **INTRAPERSONAL** GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	3.000	1.296
1.000	160	3.088	1.506

SEPARATE VARIANCES T = -0.312 DF = 36.9 PROB = 0.721  
 POOLED VARIANCES T = -0.280 DF = 184 PROB = 0.780

INDEPENDENT SAMPLES t-TEST ON **SPATIAL** GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	4.769	1.751
1.000	160	4.900	1.493

SEPARATE VARIANCES T = -0.360 DF = 31.2 PROB = 0.721  
 POOLED VARIANCES T = -0.404 DF = 184 PROB = 0.687

INDEPENDENT SAMPLES t-TEST ON **MUSIC** GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	2.692	1.715
1.000	160	2.900	1.645

SEPARATE VARIANCES T = -0.576 DF = 32.9 PROB = 0.569  
 POOLED VARIANCES T = -0.594 DF = 184 PROB = 0.554

INDEPENDENT SAMPLES t-TEST ON **BODILY-KINESTHETIC** GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	3.885	0.909
1.000	160	4.163	1.322

SEPARATE VARIANCES T = -1.345 DF = 44.3 PROB = 0.186  
 POOLED VARIANCES T = -1.032 DF = 184 PROB = 0.303

# INDEPENDENT SAMPLES t-TEST ON INTERPERSONAL GROUPED BY LANGUAGE

GROUP	N	MEAN	SD
2.000	26	3.731	1.313
1.000	160	3.538	1.537

SEPARATE VARIANCES T = 0.679 DF = 37.1 PROB = 0.502  
 POOLED VARIANCES T = 0.606 DF = 184 PROB = 0.545

## FIRST GRADE COMPARISONS ONLY:

# INDEPENDENT SAMPLES t-TEST ON LINGUISTIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	3.704	1.295
2.000	27	5.037	1.480

SEPARATE VARIANCES T = -3.522 DF = 51.1 PROB = 0.001  
 POOLED VARIANCES T = -3.522 DF = 52 PROB = 0.001

# INDEPENDENT SAMPLES t-TEST ON MATHEMATICAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	4.519	1.553
2.000	27	4.593	1.394

SEPARATE VARIANCES T = -0.184 DF = 51.4 PROB = 0.854  
 POOLED VARIANCES T = -0.184 DF = 52 PROB = 0.854

# INDEPENDENT SAMPLES t-TEST ON INTRAPERSONAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	3.889	1.625
2.000	27	3.111	1.155

SEPARATE VARIANCES T = 2.027 DF = 46.9 PROB = 0.048  
 POOLED VARIANCES T = 2.027 DF = 52 PROB = 0.048

# INDEPENDENT SAMPLES t-TEST ON SPATIAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	5.111	1.450
2.000	27	4.778	1.423

SEPARATE VARIANCES T = 0.852 DF = 52.0 PROB = 0.398  
 POOLED VARIANCES T = 0.852 DF = 52 PROB = 0.398

# INDEPENDENT SAMPLES t-TEST ON MUSIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	3.407	1.185
2.000	27	3.074	1.817

SEPARATE VARIANCES T = 0.798 DF = 44.7 PROB = 0.429  
 POOLED VARIANCES T = 0.798 DF = 52 PROB = 0.428

# INDEPENDENT SAMPLES t-TEST ON BODILY-KINESTHETIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	3.519	1.189
2.000	27	4.185	1.570

SEPARATE VARIANCES T = -1.759 DF = 48.4 PROB = 0.085  
 POOLED VARIANCES T = -1.759 DF = 52 PROB = 0.084

# INDEPENDENT SAMPLES t-TEST ON INTERPERSONAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	27	3.852	1.562
2.000	27	3.259	1.430

SEPARATE VARIANCES T = 1.454 DF = 51.6 PROB = 0.152  
 POOLED VARIANCES T = 1.454 DF = 52 PROB = 0.152

## SECOND GRADE COMPARISONS ONLY:

# INDEPENDENT SAMPLES t-TEST ON LINGUISTIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	5.032	1.494
2.000	31	4.903	1.620

SEPARATE VARIANCES T = 0.326 DF = 59.6 PROB = 0.746  
 POOLED VARIANCES T = 0.326 DF = 60 PROB = 0.746

# INDEPENDENT SAMPLES t-TEST ON MATHEMATICAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	5.290	1.755
2.000	31	4.710	1.811

SEPARATE VARIANCES T = 1.282 DF = 59.9 PROB = 0.205  
 POOLED VARIANCES T = 1.282 DF = 60 PROB = 0.205



INDEPENDENT SAMPLES t-TEST ON **INTRAPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	2.774	1.309
2.000	31	3.258	1.570

SEPARATE VARIANCES T = -1.318 DF = 58.1 PROB = 0.193  
 POOLED VARIANCES T = -1.318 DF = 60 PROB = 0.193

INDEPENDENT SAMPLES t-TEST ON **SPATIAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	4.452	1.767
2.000	31	4.935	1.526

SEPARATE VARIANCES T = -1.154 DF = 58.8 PROB = 0.253  
 POOLED VARIANCES T = -1.154 DF = 60 PROB = 0.253

INDEPENDENT SAMPLES t-TEST ON **MUSIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	2.645	1.427
2.000	31	2.710	1.829

SEPARATE VARIANCES T = -0.155 DF = 56.6 PROB = 0.878  
 POOLED VARIANCES T = -0.155 DF = 60 PROB = 0.877

INDEPENDENT SAMPLES t-TEST ON **BODILY-KINESTHETIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	4.355	1.305
2.000	31	4.065	1.340

SEPARATE VARIANCES T = 0.864 DF = 60.0 PROB = 0.391  
 POOLED VARIANCES T = 0.864 DF = 60 PROB = 0.391

INDEPENDENT SAMPLES t-TEST ON **INTERPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	31	3.387	1.667
2.000	31	3.419	1.501

SEPARATE VARIANCES T = -0.080 DF = 59.3 PROB = 0.936  
 POOLED VARIANCES T = -0.080 DF = 60 PROB = 0.936

### THIRD GRADE COMPARISONS ONLY:

#### INDEPENDENT SAMPLES t-TEST ON LINGUISTIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	4.750	1.622
2.000	24	5.542	1.693

SEPARATE VARIANCES T = -1.654 DF = 45.9 PROB = 0.105  
 POOLED VARIANCES T = -1.654 DF = 46 PROB = 0.105

#### INDEPENDENT SAMPLES t-TEST ON MATHEMATICAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	4.625	1.813
2.000	24	4.625	1.637

SEPARATE VARIANCES T = 0.000 DF = 45.5 PROB = 1.000  
 POOLED VARIANCES T = 0.000 DF = 46 PROB = 1.000

#### INDEPENDENT SAMPLES t-TEST ON INTRAPERSONAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	2.958	1.334
2.000	24	2.792	1.560

SEPARATE VARIANCES T = 0.398 DF = 44.9 PROB = 0.693  
 POOLED VARIANCES T = 0.398 DF = 46 PROB = 0.693

#### INDEPENDENT SAMPLES t-TEST ON SPATIAL GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	5.167	1.494
2.000	24	4.875	1.296

SEPARATE VARIANCES T = 0.722 DF = 45.1 PROB = 0.474  
 POOLED VARIANCES T = 0.722 DF = 46 PROB = 0.474

#### INDEPENDENT SAMPLES t-TEST ON MUSIC GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	2.417	1.742
2.000	24	2.167	1.090

SEPARATE VARIANCES T = 0.596 DF = 38.6 PROB = 0.555  
 POOLED VARIANCES T = 0.596 DF = 46 PROB = 0.554

INDEPENDENT SAMPLES t-TEST ON **BODILY-KINESTHETIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	4.417	1.100
2.000	24	4.333	0.917

SEPARATE VARIANCES T = 0.285 DF = 44.6 PROB = 0.777  
 POOLED VARIANCES T = 0.285 DF = 46 PROB = 0.777

INDEPENDENT SAMPLES t-TEST ON **INTERPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	24	3.667	1.341
2.000	24	3.708	1.546

SEPARATE VARIANCES T = -0.100 DF = 45.1 PROB = 0.921  
 POOLED VARIANCES T = -0.100 DF = 46 PROB = 0.921

**FOURTH GRADE COMPARISONS ONLY:**

INDEPENDENT SAMPLES t-TEST ON **LINGUISTIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	3.727	0.905
2.000	11	5.091	1.136

SEPARATE VARIANCES T = -3.114 DF = 19.0 PROB = 0.006  
 POOLED VARIANCES T = -3.114 DF = 20 PROB = 0.005

INDEPENDENT SAMPLES t-TEST ON **MATHEMATICAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	4.000	1.414
2.000	11	5.091	1.814

SEPARATE VARIANCES T = -1.573 DF = 18.9 PROB = 0.132  
 POOLED VARIANCES T = -1.573 DF = 20 PROB = 0.131

INDEPENDENT SAMPLES t-TEST ON **INTRAPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	2.909	1.578
2.000	11	2.364	1.502

SEPARATE VARIANCES T = 0.830 DF = 20.0 PROB = 0.416  
 POOLED VARIANCES T = 0.830 DF = 20 PROB = 0.416

INDEPENDENT SAMPLES t-TEST ON **SPATIAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	5.182	1.834
2.000	11	4.727	1.618

SEPARATE VARIANCES T = 0.616 DF = 19.7 PROB = 0.545  
 POOLED VARIANCES T = 0.616 DF = 20 PROB = 0.545

INDEPENDENT SAMPLES t-TEST ON **MUSIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	4.182	1.722
2.000	11	3.364	2.111

SEPARATE VARIANCES T = 0.996 DF = 19.2 PROB = 0.331  
 POOLED VARIANCES T = 0.996 DF = 20 PROB = 0.331

INDEPENDENT SAMPLES t-TEST ON **BODILY-KINESTHETIC** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	3.818	1.401
2.000	11	4.182	1.079

SEPARATE VARIANCES T = -0.682 DF = 18.8 PROB = 0.504  
 POOLED VARIANCES T = -0.682 DF = 20 PROB = 0.503

INDEPENDENT SAMPLES t-TEST ON **INTERPERSONAL** GROUPED BY CHAPTER

GROUP	N	MEAN	SD
1.000	11	4.182	0.982
2.000	11	3.273	1.849

SEPARATE VARIANCES T = 1.440 DF = 15.2 PROB = 0.170  
 POOLED VARIANCES T = 1.440 DF = 20 PROB = 0.165

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